Generation Interconnection Feasibility Study Report W4-098

The Interconnection Customer (IC) has proposed a 10 MWE (3.8 MWC) solar powered generating facility consisting of ground mounted, fixed panel, solar photovoltaic arrays. The project is to be located in Newport, New Jersey. PJM studied W4-098 as a 10 MW injection into the Atlantic City Electric (ACE) system at a tap of the W1-089 TAP – W1-117Tap 69kV circuit. The project was evaluated for compliance with reliability criteria for summer peak conditions in 2014. The proposed in-service date, as stated in Attachment N, is December 31, 2011.

Point of Interconnection

W4-098 will interconnect with the Atlantic City Electric transmission system at a new 69kV three (3)-breaker ring bus substation adjacent to the UNIMIN-US Silica 69kV circuit.

Direct Connection Requirements

Transmission Owner Scope of Direct Connection Work

The scope of work and estimated costs for the direct connection facilities is as follows:

Substation Engineering Estimate:
Scope: Construct a 69kV three-breaker ring bus substation, inclusive of a terminal position for queue project
Estimate: $3,450,000
Construction Time: 24 – 36 months

Transmission Engineering Estimate:
Scope: Install a self-supporting 69kV steel pole with a concrete foundation, motor operated disconnects and a short span to PHI substation
Estimate: $125,000
Construction Time: 24 months.

Note: If location of generator is greater than 500 feet from substation, circuit breaker will be necessary

Additional costs upon further engineering review may result. Contribution in Aid of Construction (CIAC) tax will be included upon further study.

Interconnection Customer Scope of Direct Connection Work

The Interconnection Customer (IC) is responsible for all design and construction related activities on their side of the Point of Interconnection. Site preparation, including grading and an access road, as necessary, is assumed to be by the IC. Route selection, line design, and right-of-way acquisition of the direct connect facilities is not included in this report, and is the responsibility of the IC. The Interconnection Customer will be responsible for contributing to future O & M costs associated with

the direct connect facilities.

Protective relaying and metering design and installation must comply with PHI's applicable standards. The IC is also required to provide revenue metering and real-time telemetering data to PJM in conformance with the requirements contained in PJM Manuals M-01 and M-14 and the PJM Tariff. PHI will require the capability to remotely trip the generator from its System Operations facility. The interconnected customer will grant its permission for PJM to send PHI all telemetry that the Interconnection Customer sends to PJM. The Interconnection Customer will be required to make provisions for a voice quality phone line within approximately 3 feet of each PHI metering position to facilitate remote interrogation and data collection.

Transmission Network Impacts

Potential transmission network impacts are as follows:

Generator Deliverability

*(Single or N-1 contingencies for the **Capacity** portion only of the interconnection)*

1. (AE/PSEG) The Monroe-New Freedom 230kV line (from bus 228402 to bus 219100 ckt 1) loads from 100.00% to 100.02% (DC power flow) of its emergency rating (805 MVA) for the single contingency 'PS18'. This project contributes approximately 1.02 MW to the thermal violation.

Multiple Facility Contingency

*(Double Circuit Tower Line, Line with Failed Breaker and, Bus Fault contingencies for the **Full** energy output.*

None

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

1. (AE) The Wheaton Alt Tap-Second Street #1 69kV line (from bus 228233 to bus 228225 ckt 1) loads from 102.52% to 105.55% (DC power flow) of its emergency rating (74 MVA) for the single contingency 'SO MIL-BUT_W2-39B'. This project contributes approximately 2.24 MW to the thermal violation.

2. (AE) The W1-085TAP1-South Millville 69kV line (from bus 901640 to bus 228228 ckt 1) loads from 256.66% to 267.1% (DC power flow) of its emergency rating (60 MVA) for the tower contingency 'AE11TOWER'. This project contributes approximately 6.27 MW to the thermal violation.

3. (AE) The South Millville-Ball Foster North Tap 69kV line (from bus 228228 to bus 228215 ckt 1) loads from 105.41% to 108.52% (DC power flow) of its emergency rating (72 MVA) for the

single contingency 'SO MIL-BUT_W2-39B'. This project contributes approximately 2.24 MW to the thermal violation.

Short Circuit

None. Any other costs determined by system protection as a result of the short circuit studies will be supplied in the near future.

Stability Analysis

Not required due to project size.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. "Network Impacts," initially caused by the addition of this project's generation)

1. To mitigate the MONROE-NEW FRDM 230kV (AE/PSEG) line overload will require a rebuild and reconductor of the 6.91 mile Monroe-New Freedom 230kV line with a bundled conductor. The estimated cost to perform this work is $**16,600,000** and will take **36 months** to complete from the time "Notice to Proceed" is given after the ISA and CSA are executed.

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project.

1. To mitigate the Wheaton Alt Tap-Second Street #1 69kV line overload will require a relay adjustment or replacement. Costs to perform this work are expected to be minimal and will be provided in the System Impact Study Report.

2. To mitigate the W1-085TAP1-South Millville 69kV line overload will require the reconductor of approximately 2.9 miles of circuit with 795 ACSR conductor. The estimated cost to perform this work is **$1,500,000** and will take **24 to 36 months** to compete following receipt of a fully executed Interconnection Services Agreement(ISA) and Interconnection Construction Services Agreement (CSA)

3. To mitigate the South Millville-Ball Foster North Tap 69kV line (from bus 228228 to bus 228215 ckt 1) overload will require an upgrade to the 69kV strand bus and current transformer at Second Street. The estimated cost to perform this work is **$250,000** and will take **18 to 24 months** to complete.

Potential Congestion due to Local Energy Deliverability

(PJM also studied the delivery of the energy portion of the surrounding generation. Any potential problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with Network Upgrades to eliminate the operational restriction at their discretion by submitting a Transmission Interconnection Request. Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full deliverability for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which analyzes all overload conditions associated with the identified overloaded element(s). As a result of the aggregate energy resources in the area, the following violations were identified:

These are ***not*** required reliability upgrades.

1. (AE) The Ball Foster North Tap-Wheaton Alt Tap 69 kV line (from bus 228215 to bus 228233 ckt 1) loads from 176.40% to 182.67% (DC power flow) of its emergency rating (94 MVA) for the operational contingency 'SO MIL-BUT_W2-39B'. This project contributes approximately 5.90 MW to the thermal violation.

2. (AE) The Ball Foster North Tap-Wheaton Alt Tap 69 kV line (from bus 228215 to bus 228233 ckt 1) loads from 118.13% to 122.78% (DC power flow) of its normal rating (77 MVA) for non contingency condition. This project contributes approximately 3.57 MW to the thermal violation.

3. (AE) The Laurel-Laurel 69 kV line (from bus 228259 to bus 228218 ckt 1) loads from 126.27% to 131.71% (DC power flow) of its emergency rating (149 MVA) for the operational contingency 'USLC-SM_V4-036B_WITH_W1-085B'. This project contributes approximately 8.11 MW to the thermal violation.

4. (AE) The W4-098 TAP-W1-089TAP1 69 kV line (from bus 905860 to bus 901680 ckt 1) loads from 78.41% to 100.15% (DC power flow) of its normal rating (46 MVA) for non contingency condition. This project contributes approximately 10.00 MW to the thermal violation.

5. (AE) The South Millville-W2-039 TAP 69 kV line (from bus 228228 to bus 902520 ckt 1) loads from 118.12% to 124.43% (DC power flow) of its emergency rating (89 MVA) for the operational contingency 'SS-SMLVIL'. This project contributes approximately 5.62 MW to the thermal violation.

6. (AE) The W2-039 TAP-Butler 69 kV line (from bus 902520 to bus 228703 ckt 1) loads from 178.69% to 185.0% (DC power flow) of its emergency rating (89 MVA) for the operational contingency 'SS-SMLVIL'. This project contributes approximately 5.62 MW to the thermal violation.

7. (AE) The W2-039 TAP-Butler 69 kV line (from bus 902520 to bus 228703 ckt 1) loads from 108.70% to 112.75% (DC power flow) of its normal rating (66 MVA) for non contingency condition. This project contributes approximately 2.67 MW to the thermal violation.

8. (AE) The W1-089TAP1-Us Silica #1 69 kV line (from bus 901680 to bus 228221 ckt 1) loads from 117.52% to 139.26% (DC power flow) of its normal rating (46 MVA) for non contingency condition. This project contributes approximately 10.00 MW to the thermal violation.

9. (AE) The Wheaton Alt Tap-Second Street #1 69 kV line (from bus 228233 to bus 228225 ckt 1) loads from 224.03% to 232.0% (DC power flow) of its emergency rating (74 MVA) for the operational contingency 'SO MIL-BUT_W2-39B'. This project contributes approximately 5.90 MW to the thermal violation.

10. (AE) The Wheaton Alt Tap-Second Street #1 69 kV line (from bus 228233 to bus 228225 ckt 1) loads from 137.79% to 143.21% (DC power flow) of its normal rating (66 MVA) for non contingency condition. This project contributes approximately 3.57 MW to the thermal violation.

11. (AE) The Us Silica Tap-V4-036TAP1 69 kV line (from bus 228222 to bus 900350 ckt 1) loads from 115.12% to 122.56% (DC power flow) of its emergency rating (89 MVA) for the operational contingency 'CARLL-SHERM'. This project contributes approximately 6.62 MW to the thermal violation.

12. (AE) The Us Silica Tap-V4-036TAP1 69 kV line (from bus 228222 to bus 900350 ckt 1) loads from 105.11% to 114.62% (DC power flow) of its normal rating (65.6999969482 MVA) for non contingency condition. This project contributes approximately 6.25 MW to the thermal violation.

13. (AE) The Fairton-Laurel 69 kV line (from bus 228214 to bus 228259 ckt 1) loads from 195.28% to 206.03% (DC power flow) of its emergency rating (93 MVA) for the operational contingency 'USLC-SM_V4-036B_WITH_W1-085B'. This project contributes approximately 10.00 MW to the thermal violation.

14. (AE) The V4-036TAP1-W1-085TAP1 69 kV line (from bus 900350 to bus 901640 ckt 1) loads from 169.35% to 186.02% (DC power flow) of its emergency rating (60 MVA) for the operational contingency 'LAUR-FAIR'. This project contributes approximately 10.00 MW to the thermal violation.

15. (AE) The V4-036TAP1-W1-085TAP1 69 kV line (from bus 900350 to bus 901640 ckt 1) loads from 158.43% to 170.22% (DC power flow) of its normal rating (53 MVA) for non contingency condition. This project contributes approximately 6.25 MW to the thermal violation.

16. (AE) The Carlls Corner-Sherman 69 kV line (from bus 228252 to bus 228226 ckt 1) loads from 235.76% to 243.83% (DC power flow) of its emergency rating (56 MVA) for the operational contingency 'NEWPORT-SM'. This project contributes approximately 4.52 MW to the thermal violation.

17. (AE) The Us Silica Tap-Newport 69 kV line (from bus 228222 to bus 228219 ckt 1) loads from 269.60% to 287.78% (DC power flow) of its emergency rating (55 MVA) for the operational contingency 'USLC-SM_V4-036B_WITH_W1-085B'. This project contributes approximately 10.00 MW to the thermal violation.

18. (AE) The Us Silica Tap-Newport 69 kV line (from bus 228222 to bus 228219 ckt 1) loads from 122.82% to 130.33% (DC power flow) of its normal rating (50 MVA) for non contingency condition. This project contributes approximately 3.75 MW to the thermal violation.

19. (AE) The W1-085TAP1-South Millville 69 kV line (from bus 901640 to bus 228228 ckt 1) loads from 247.13% to 263.8% (DC power flow) of its emergency rating (60 MVA) for the operational contingency 'NEWPRT-USLC'. This project contributes approximately 10.00 MW to the thermal violation.

20. (AE) The W1-085TAP1-South Millville 69 kV line (from bus 901640 to bus 228228 ckt 1) loads from 273.53% to 285.32% (DC power flow) of its normal rating (53 MVA) for non contingency condition. This project contributes approximately 6.25 MW to the thermal violation.

21. (AE) The South Millville-Ball Foster North Tap 69 kV line (from bus 228228 to bus 228215 ckt 1) loads from 230.30% to 238.49% (DC power flow) of its emergency rating (72 MVA) for the operational contingency 'SO MIL-BUT_W2-39B'. This project contributes approximately 5.90 MW to the thermal violation.

22. (AE) The South Millville-Ball Foster North Tap 69 kV line (from bus 228228 to bus 228215 ckt 1) loads from 142.13% to 147.72% (DC power flow) of its normal rating (64 MVA) for non contingency condition. This project contributes approximately 3.57 MW to the thermal violation.

23. (AE) The Us Silica #1-Us Silica Tap 69 kV line (from bus 228221 to bus 228222 ckt 1) loads from 91.34% to 110.21% (DC power flow) of its normal rating (53 MVA) for non contingency condition. This project contributes approximately 10.00 MW to the thermal violation.

24. 29. (AE) The Newport-Fairton 69 kV line (from bus 228219 to bus 228214 ckt 1) loads from 282.94% to 303.77% (DC power flow) of its emergency rating (48 MVA) for the operational contingency 'USLC-SM_V4-036B_WITH_W1-085B'. This project contributes approximately 10.00 MW to the thermal violation.